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IS 10260-2 (1982): Terms, definitions and classification of plain bearings, Part II: Friction and wear [PGD 13: Bearing]

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Indian Standard (Reaffirmed 2005)

TERMS, DEFINITIONS AND CLASSIFICATION OF PLAIN BEARING

PART II FRICTION AND WEAR

1. Scope — Covers the most commonly used terms, with their definitions and classification, applied to friction and wear of plain bearings.

1.1 For some of the terms and word-combinations their short forms are given which are recommended for use when they are unambiguous. Self-explanatory terms are given without definitions.

2. General Terms

2.1 *External Friction* — Phenomenon of resistance to relative motion between two bodies, originating at their surface contact area and directed tangentially to them.

2.2 *Internal Friction* — Phenomenon of resistance to relative motion of the parts of one and the same body.

2.3 *Wear Process* — Process of a loss of substance from a solid body surface due to friction and/or build-up of its permanent deformation, displayed as a gradual change of body dimensions and/or shape.

2.4 *Wear* — Result of a wear process expressed in specified units.

Note — Wear may be expressed in the units of length, volume, mass, etc.

3. Types and Characteristics of External Friction

3.1 Types and characteristics of external friction in plain bearing shall be as follows:

3.1.1 *According to the presence of relative motion:*

- a) Static friction, and
- b) Dynamic friction.

3.1.2 *According to the character of relative motion:*

- a) Sliding friction,
- b) Rolling friction, and
- c) Combined rolling and sliding friction.

3.1.3 *According to the presence of lubricant:*

- a) Unlubricated friction, and
- b) Lubricated friction.

3.2 *Static Friction* — Friction between two bodies during microdisplacement before macrodisplacement.

3.3 *Dynamic Friction* — Friction between two bodies in relative motion.

3.4 *Sliding Friction* — Dynamic friction in which the tangential velocities of the contacting bodies at the contact area differ in magnitude and/or direction.

3.5 *Rolling Friction* — Dynamic friction in which the tangential velocities of the contacting bodies are identical both in magnitude and direction at least at one point of the contact area.

3.6 *Combined Rolling and Sliding Friction* — Dynamic friction between two contacting bodies when rolling and sliding friction take place simultaneously at the contact area.

3.7 *Unlubricated Friction* — Friction between two bodies when no lubricant is intentionally applied on the rubbing surface.

3.8 *Lubricated Friction* — Friction between two bodies with a lubricant applied on the rubbing surface.

Plain Bearings Sectional Committee, EDC 80 [Ref : Doc : EDC 80 (3836)]

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3.9 *Friction Force* — Resisting force tangential to the common boundary between two bodies when, under the action of an external force, one body moves relative to the surface of the other.

3.10 *Maximum Static Friction Force* — Static friction force, exceeding of which initiates macro-displacement.

3.11 *Coefficient of Friction* — Ratio of the friction force between two bodies to the normal force pressing these bodies together.

3.12 *Sliding Velocity* — Difference between tangential velocities of the bodies at the point of their contact during sliding.

3.13 *Sliding Surface* — Body surface subjected to friction.

4. Types and Characteristics of Wear Process

4.1 Type and characteristics of wear process in plain bearing shall be as follows:

i) *Mechanical wear*:
  a) Mechanical wear,
  b) Abrasive wear,
  c) Hydroabrasive (gasabrasive) wear,
  d) Fluid erosion,
  e) Fatigue wear,
  f) Cavitation wear,
  g) Fretting wear, and
  h) Adhesive wear.

ii) *Mechano-chemical wear*:
  a) Mechano-chemical wear,
  b) Fretting corrosion, and
  c) Oxidative wear.

iii) *Wear under the action of electric current:*
  a) Electroerosive wear.

4.2 *Mechanical Wear* — Process of wear due to mechanical actions.

4.3 *Abrasive Wear* — Process of mechanical wear of a material, caused by cutting or scratching actions of hard bodies or hard particles.

4.4 *Hydroabrasive (gasabrasive) Wear* — Process of wear due to the action of hard bodies or hard particles carried in a flowing fluid or gas.

4.5 *Fluid Erosion* — Process of wear due to the action of streaming liquid or gas.

4.6 *Fatigue Wear* — Process of mechanical wear caused by fatigue destruction during repeated deformations of microvolumes of the rubbing surface material.

Note — Fatigue wear may occur both during sliding and rolling.

4.7 *Cavitation Wear* — Process of mechanical wear when a solid body moves relative to a liquid in which vapour bubbles collapse close to the surface thus causing local high impact pressure or high temperature.

4.8 *Fretting Wear* — Process of mechanical wear of the contacting bodies having oscillatory relative motion of small amplitude.

4.9 *Adhesive Wear* — Process of wear due to adhesion, extraction of material out of the body surface, its transfer from one rubbing surface to another one and the effect of thus formed irregularities on the adjacent surface.

4.10 *Mechano-Chemical Wear* — Process of wear due to mechanical action accompanied by chemical and/or electrochemical interaction of the material with the environment.

4.11 *Oxidative Wear* — Process of mechano-chemical wear in which chemical reaction of the material with oxygen or oxidizing media predominates.

4.12 *Fretting Corrosion* — Process of mechano-chemical wear of the contacting bodies having oscillatory relative motion of small amplitude.

4.13 *Electroerosive Wear* — Process of wear of the surface due to the action of discharges caused by electric current.

4.14 *Wear Rate* — Ratio of wear extent to the time interval during which it has developed.

Note — Wear rate is distinguished as "momentary" (at a definite moment) and as "mean" wear rate (during a definite interval of time).

4.15 *Wear Intensity* — Ratio of wear extant to the specified distance on which wear develops or to the volume of the work done.

Note 1 — The choice of units to express the volume of work is determined for each particular case.

Note 2 — Wear intensity is distinguished as "momentary" or as "mean".

5. Phenomena and Processes in Friction and Wear

5.1 *Stick-slip Motion* — Phenomenon of alternation of relative sliding and relative state of rest or an alternative increase and decrease of relative sliding velocity developing spontaneously during dynamic friction.

Note — An example of stick-slip motion is the motion caused by auto-oscillations developing at decrease of coefficient of friction with increase of sliding velocity.

5.2 *Adhesion in Friction (Adhesion)* — Phenomenon of local attraction of two rubbing solid bodies due to the action of molecular forces.

5.3 *Transfer of Material* — Phenomenon developing during friction when the material of one body adheres to another body and, on being detached from the first, remains on the surface of the second body.

5.4 *Seizure* — Process of formation and developing of damages on rubbing surfaces due to adhesion and transfer of material.

Note — Seizure may result in stopping of relative motion.

5.5 *Scoring* — Damage of the rubbing surface in the form of severe scratches in the direction of sliding.

5.6 *Scratching* — Formation of fine scratches on the surface in the direction of sliding due to irregularities on the harder sliding surface or due to hard particles.

5.7 *Spalling* — Separation of particles of material from a surface in the form of flakes due to fatigue wear.

5.8 *Pitting* — Process of cavity formation on the rubbing surface due to detachment of particles of material during fatigue wear.

5.9 *Running-in* — Process of changing the rubbing surface geometry as well as physical and mechanical properties of material surface layers during the initial period of friction usually displayed under constant outside conditions like decrease of friction force, temperature and wear intensity.

EXPLANATORY NOTE

This standard was earlier covered in IS : 4757-1968 'Dimensions for wrapped bushes and thrust washers' and IS : 4774-1968 'Thin-walled bearings and thrust half-washers'. On the basis of the current international practices, the concerned committee felt the necessity to bring out a separate standard on plain bearing terminology to make it in line with ISO/DIS 4378/1 'Plain bearing-vocabulary: Part I Construction', ISO/DIS 4378/2 'Plain bearing-vocabulary: Part 2 Friction and wear', and ISO/DIS 4378/3 'Plain bearing-vocabulary: Part 3 Lubrication', issued by International Organisation for Standardization. The standard consists of the following parts:

IS : 10260 (Part I)-1982 Terms, definitions and classifications of plain bearing: Part I Construction.

IS : 10260 (Part II)-1982 Terms, definitions and classification plain bearing: Part II Friction and wear.

IS : 10260 (Part III)-1982 Terms, definitions and classifications of plain bearing: Part III Lubrication.

These standards have been prepared for the guidance of the manufacturers and consumers to assist them for the correct interpretation of the terminology related to the plain bearings.

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